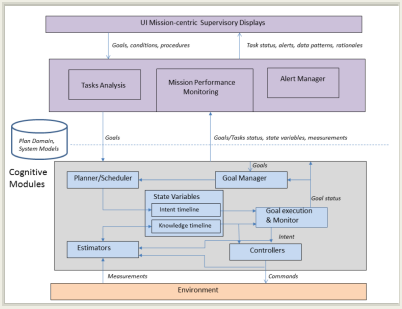
Small Business Innovation Research/Small Business Tech Transfer

Integration Framework for Building Autonomous Intelligent Systems, Phase I

Completed Technology Project (2017 - 2017)

Project Introduction

Among the many challenges of Mars exploration is the creation of autonomous systems that support crew activities without reliance on Earth mission control. These intelligent autonomous systems will have different levels of autonomy and will be designed to effectively communicate with the crew. These autonomous systems will be transparent (able to explain what they are doing) in order for crew members to trust them. It remains still a challenge to build highly intelligent, collaborative and transparent autonomous systems. With the existence of so many algorithms, knowledge representation techniques, and autonomous agents architectures, it is desirable to have a general integration architecture that allows the quickly evaluation of proposed software modules facilitating in turn the evaluation of diverse software configurations. We propose the development of an autonomous agents integration architecture for the definition of goal directed agents exhibiting transparent task execution behavior. The architecture has as goals to (i) facilitate the integration of existing algorithms and systems employed by most autonomous agents architectures, (ii) define how these modules interact and the ontology used to communicate data between these modules, (iii) provide default implementations for the four basic modules in the architecture (goal manager, planner, diagnosis, task executor), and (iv) provide insight on how to build transparent autonomous agents that can effectively communicate with the crew (e.g., explain the rationale behind key decisions during a task execution). During Phase I we will show the utility and feasibility of the integration architecture by (i) developing operational CONOPs describing envisioned tasks done by autonomous agents, (ii) identifying specific technologies that will be integrated during Phase II, and (iii) developing a software prototype illustrating the agents capabilities in scenarios of interest to NASA.



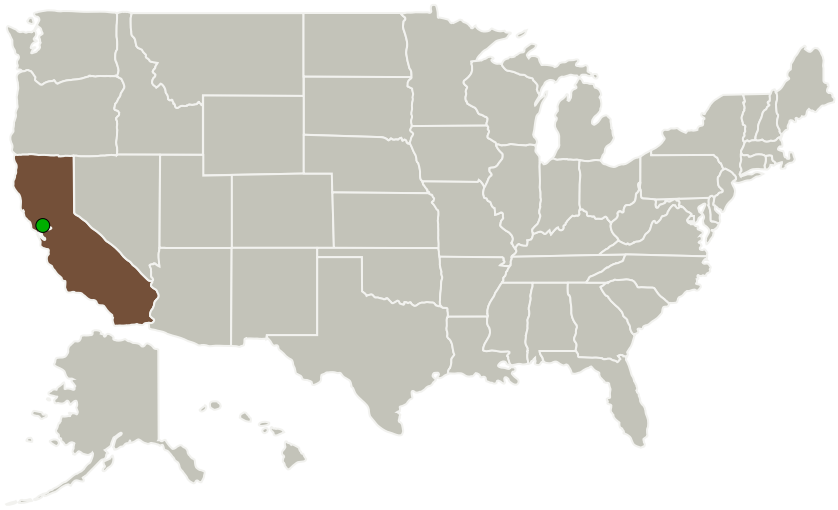
Integration Framework for Building Autonomous Intelligent Systems, Phase I Briefing Chart Image

Table of Contents

Integration Framework for Building Autonomous Intelligent Systems, Phase I

Completed Technology Project (2017 - 2017)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Stottler Henke Associates, Inc.	Lead Organization	Industry	San Mateo, California
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations
California

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Stottler Henke Associates, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

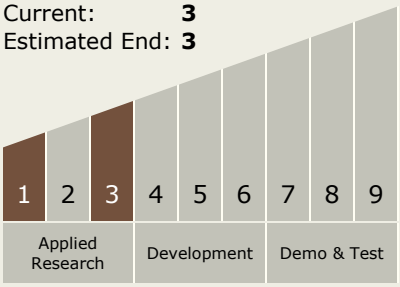
Carlos Torrez

Principal Investigator:

Emilio A Remolina

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



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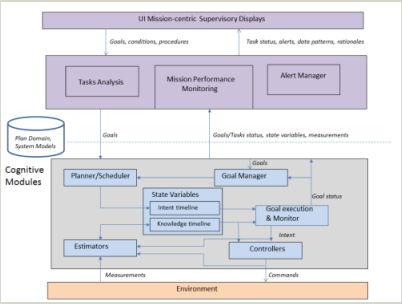
Images



Briefing Chart Image
Integration Framework for Building Autonomous Intelligent Systems, Phase I Briefing Chart Image *(https://techport.nasa.gov/image/129761)*

Technology Areas

Primary:

- TX10 Autonomous Systems
  - TX10.2 Reasoning and Acting
    - TX10.2.7 Learning and Adapting

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System